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RESPONSE TO DETAILED ACTION

#412  
6/9/03

June 2, 2003

Commissioner for Patents

PO Box 1450

Alexandria, VA 22313-1450

Petition to examiner Wayne A. Langel.

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Referring to Office Action Summary date mailed 05/21/ 2003, regarding patent application serial number 09/841,504, filed by Gene E. Lightner 04/24/2001, response to Detailed Action is enclosed within said response is in the form of paragraphs and is referred to by numbers.

1. In regard to the quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

“(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.”

The present invention, discloses a method to convert a gas containing water vapor, hydrocarbons and carbon monoxide to carbon dioxide and hydrogen. Furthermore said gas is derived from a biomass. Substantial differences between prior art is evident. Therefore, the situation within 35 U.S.C. 103(a) is immaterial to the present invention

2. Concerning rejection of claims 1-15 under 35 U.S.C. 103 (a), as being unpatentable over Yamaguchi, et al. in view of Scott, and further in view of Takeuchi et al. Yamaguchi, et al. teaches pyrolysis of solid wastes by a furnace to obtain a gas for fuel. Furthermore these teachings are devoid of specifying a biomass. Takeuchi et al. teaches a process for gasifying wastes by supplying steam and air. These teachings are lacking disclosure of catalysts, with corresponding catalytic activity. In contrast, within claim 1 of the present invention, a method to produce hydrogen from a gas containing water vapor, hydrocarbons, and carbon monoxide is presented. Gas produced from gasification is unspecified as such within claim 1 but is sufficient within said method. Scott teaches hydrogasification of a biomass to produce high yields of methane. Hence these teachings are inapplicable related to the present invention. Also Scott presents the well known process of water gas shift reaction utilizing steam within Figure 1 and claim 8. Whereas, within the present invention, a gas containing water vapor and carbon

monoxide is subjected to a steam shift reaction, so that a supply of steam is unnecessary. Hence *prima facie* evidence of a supply of steam with the object of a shift reaction is obviously lacking within the present invention.

3. Relative to the subject of partial oxidation, partial oxidation is a well known procedure regularly used to supply heat for gasification is practiced and is employed within the present invention.

4. Regarding the topic of flue gas, this term is deleted within amended claim 1, as presented.

1. (amended) A method to produce hydrogen from a gas containing water vapor, hydrocarbons, and carbon monoxide,

which comprises:

providing a gas containing water vapor and carbon monoxide derived from a biomass, and

[providing a flue gas by means of combustion of a biomass, and]

providing a catalyst for steam reforming [said gas containing] hydrocarbons contained within said gas, and

providing a catalyst for steam shifting gas derived from steam reforming containing carbon monoxide, and

subjecting [said] the gas containing water vapor, hydrocarbons, and carbon monoxide to said catalyst for steam reforming to form hydrogen and carbon monoxide, and

subjecting gas following steam reforming containing water vapor and carbon monoxide to said catalyst for steam shifting to form hydrogen and carbon dioxide, and

thereby producing a gas containing hydrogen derived from a biomass.

Thus the topic of flue gas has been deleted from claim 1 without specifying the term "flue gas."

5. Regarding figure 1 and abstract within specification page 1, terms combustion and flue gas refers to solid remains from partial oxidation to form flue gas. For clarification, specification abstract of page 1 is amended as follows: abstract(amended)

## PRODUCTION OF HYDROGEN FROM BIOMASS

### ABSTRACT

[Partial oxidation of a biomass is employed to provide producer gas] Producer gas, is composed of hydrogen and a gas containing water vapor, hydrocarbons, and carbon monoxide

[followed by complete combustion of resulting solid remains from partial oxidation to provide a flue gas to furnish heat for the method.] Producer gas is obtained by partial oxidation of a biomass followed by complete combustion of resulting solid remains from partial oxidation to provide a flue gas to furnish heat for the method. Producer gas is subjected to a steam reforming catalyst provided by heat from the flue gas for reforming of hydrocarbons contained in the producer gas to produce hydrogen and carbon monoxide. Following reforming, the gas, containing water vapor, is subjected to a steam shifting catalyst provided by heat from the flue gas to replace endothermic heat [required] to produce hydrogen and carbon dioxide. Remaining residue from combustion of the biomass is subjected to heat exchange to heat air for combustion. Shifted gas, containing substantial sensible heat, is employed to transfer heat to air and furnish heated air for partial oxidation. Whereas Takeuchi, et al., teaches a single supply of air for combustion of and after gasification. In contrast, figure 1 indicate separate supplies of air.

6. Pertaining to the teachings of Takeuchi et al. in which addition of steam is specified.

Removal of solid remains from partial oxidation is specified in Figure 1, of the present invention, for complete combustion of resulting solid remains from partial oxidation to generate flue gas. Consequently solid remains from the gasification (partial oxidation) stage are removed from said stage and transferred to a combustion stage for complete combustion of resulting solid remains from partial oxidation to provide a flue gas. This situation is presented within Figure 1 of the present invention, is fundamentally different from the teachings of Takeuchi, et al. Moreover independent claims 4, 5, 6, 7 and 8 designate that solids obtained from partial oxidation of a biomass, subjected to combustion, create a flue gas for employment as a supply of energy for the method.

7. Regarding rejection of claims 1-15 under 35 U.S.C. 103 (a) as being unpatentable over Scott in view of Takeuchi et al. The examiner should refer to amended claim 1 for deletion of the topic of flue gas, as this term is deleted within amended claim 1. Refer to claims 4, 5, 6, 7 and 8 wherein energy consumed in the method, including steam reforming zone, is supplied by flue gas derived from combustion of remains from partial combustion as specified in Figure 1, of the present invention.

8 Pertaining to rejection of claims 1-15 under 35 U.S.C. 112, second paragraph as being indefinate for failing to particularly point out and distinctly claiming the subject matter which the applicant regards as the invention. Quotation from page 5, lines 12-14, "In the preferred

embodiment of the present invention production of hydrogen derived from a supplied biomass is presented. Producer gas, by catalytic essential changes, provide hydrogen and carbon dioxide.” Moreover, pages 7-8, within amended claims 1-15, the preferred embodiments of the present invention, are contributed as the subject matter which the applicant regards as the invention. The topic of flue gas, has been deleted, and alterations made, within amended claim 1 for clarification of intent. So that the term “said gas” has only one meaning and refers to a gas containing water vapor and carbon monoxide derived from a biomass.

9. As regards to the Markush group within claim 12, this claim is rendered definite within the amended claim 12 so that proper grammar is engaged, such as the Markush group allowed within claim 5 of U.S. patent number 6,565,824.

12. (amended) The method of claim 4 wherein the biomass is selected from the group consisting of wood, waste paper and municipal solid waste including an individual or [a] combination [of these materials] thereof.

10 Pertaining to rejection of claims 1-4 and 9-15 under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. Figure 1 and the specification reveal partial oxidation of a biomass as a means for producing producer gas which is represented within claim 1 as providing a gas containing water vapor and carbon monoxide derived from a biomass, in which partial combustion of a biomass produces said gas. Thus producer gas is the same as said gas. The formation of remains of partial oxidation for subsequent combustion is disclosed within claim 4 and claim 5. Disclosed within claim 15 is the supply of water vapor from moisture contained within a biomass. Claim 2 and claim 3. perform catalytic reaction of gas containing water vapor and carbon monoxide. Claims 9-11 and claims 12-14 disclose factors obtained from specification page 4, lines 16-28 and figures 1-4. Thus the governing factors of 35 U.S.C. 112, first paragraph, are fulfilled. Relative to in re Mayhew, 527 F.2d 1229, 188 USPQ 356 (CCPA 1978). Upon reviewing the disclosure in re Mayhew, it was determined that this conclusion is inapplicable to the present invention.

11. Pertaining to the teachings of Cahn et al. made of record. These teachings are inapplicable to the present invention.

12. Pertaining to the teachings of Yokoyame et al. made of record. These teachings are inapplicable to the present invention.

13. Pertaining to the teachings of Fujimura, et al. '224 and Fujimura, et al. '858 made of record. These teachings are inapplicable to the present invention.

14. Pertaining to the teachings of Michel-Kim, made of record. These teachings are inapplicable to the present invention.

15. Pertaining to the teachings of White '677, White '227, and White '116, made of record. These teachings are inapplicable to the present invention.

16. Regarding amendment of claim 1 to incorporate the limitations of claim 4 and claim 5. This suggestion is voluntary and unnecessary due to the amended specification which define the producer gas as the primary objective of partial oxidation and partial oxidation is of minor importance within the method.

17. Concerning this communication or earlier communication from the examiner, an inquiry is unforeseen at this time.

18. Concerning amendment of specification page 6, lines 1-11 this amendment will exclude unwanted letters. Specification page 6, lines 1-11 (amended)

Similarly, flue gas [B] 24B is transported to steam shift catalysis stage 42, to transfer heat from flue gas [B] 24B and generate flue gas [C] 24C of reduced sensible heat and produce gaseous mixture 14B.

Residue 26 can remain within combustion stage 20 for heating of air thus requiring an unnecessary heat exchange stage 28 to provide heat air 30. Flue gas [A] 24A is essential to the method to replace endothermic heat of both catalytic reactions. Complete combustion by heated air 22 is required to form a sufficient quantify of flue gas. The remaining solids from partial combustion 18 may be contained in a single vessel for combustion within combustion stage 20 with separate outlets for producer gas 14 and flue gas 24A.

Referring to Fig. 2, flue gas [C] 24C is conveyed to biomass dryer stage 46 to provide heat to supplied biomass 10 to remove water and provide biomass of reduced water 10A and flue gas [D] 24D. Thus specification page 6, lines 1-11 has been amended.



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Requirements of 35 U.S.C. 112, appropriate paragraphs, have been fulfilled.

Prior art presented, is immaterial to the present invention.

The fact that the present invention is both novel and unobvious to one skilled in the art has been accordingly established.

Specification page 6, lines 1-11 (amended) is contributed in order to exclude unwanted letters.

Claim 12. has been amended to accomplishment the Markush group allowed within claim 5 of U.S. patent number 6,565,824.

It is expected that, upon examination of these remarks and related response, the amended claims and specification page 1 and page 5 will be allowed by the examiner, as requested.

Clean copies (4 pages) of the amended claims and amended specification are enclosed.

Very respectfully,

*Gene E Lightner*

Gene E. Lightner

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